

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:	)	Group Art Unit: 1763
	)	
Martin, <i>et al.</i>	)	Examiner: Maureen G. Arancibia
	)	
Serial No.: 10/784,697	)	Confirmation No.: 1334
	)	
Filed: 2/23/04	)	Docket No.: 062002-1752
	)	
For: METHOD AND APPARATUS	)	
FOR LOW ENERGY	)	
ELECTRON ENHANCED	)	
ETCHING OF SUBSTRATES	)	
IN AN AC OR DC PLASMA	)	
ENVIRONMENT	)	

APPEAL BRIEF UNDER 37 C.F.R. §1.192

Mail Stop Appeal Brief - Patents  
Commissioner of Patents and Trademarks  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Sir:

This is an appeal from the decision of Examiner Maureen G. Arancibia, Group Art Unit 1763, mailed August 1, 2006 (and the Advisory Action mailed April 14, 2005) rejecting, for the second time, claims 1 – 2, 4 – 7, 9 – 11, and 16 – 26 of the above-referenced application.

### **I. REAL PARTY IN INTEREST**

The real party in interest of the instant application is Georgia Tech Research Corporation, a Georgia non-profit corporation, having its principal place of business in Atlanta, Georgia.

### **II. RELATED APPEALS AND INTERFERENCES**

There are no related appeals or interferences.

### **III. STATUS OF THE CLAIMS**

Claims 1 – 2, 4 – 7, 9 – 11, and 16 – 26 are pending in this application. Through prosecution of this matter, claims 3, 8, and 12 – 15 have been canceled without prejudice, waiver, or disclaimer. The Office Action has rejected independent claim 1 and dependent claims 2, 4 – 7, 9 – 11 and 23 – 25 as allegedly being unpatentable over U.S. Patent 4,950,376 to Hayashi et al. (“Hayashi”) in view of U.S. Patent 5,279,669 to Lee (“Lee”). The Office Action also rejects independent claim 16 and dependent claims 17 – 18 as allegedly being unpatentable over Hayashi et al. in view of U.S. Patent 6,231,777 to Kofuji et al. (“Kofuji”). The Office Action also rejects dependent claims 19 – 22 and 26 as allegedly being unpatentable over Hayashi in view of Kofuji and further in view of Lee. Claims 1, 2, 4 – 7, 9 – 11 and 23 – 25 are rejected under 35 U.S.C. 112, second paragraph as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Office Action also objects to claim 7 as having an informality. For the reasons set forth herein, Applicant submits that these rejections are misplaced and should be overturned by the Board.

#### **IV. STATUS OF AMENDMENTS**

No amendments have been made or requested to any of the claims after the Office Action, and all amendments submitted or requested before the mailing of the Office Action have been entered. A copy of the current claims is attached hereto as Appendix A.

#### **V. SUMMARY OF CLAIMED SUBJECT MATTER**

Reference is made to a number of locations in the specification and figures with respect to summarizing the claimed subject matter as required by 37 C.F.R. 41.37(c)(1)(v). However, it should be understood that various related aspects of the present invention as described in the claims may be described elsewhere in the specification and figures as well.

The present application is directed to a method and apparatus for low energy electron enhanced etching of substrates in an AC or DC plasma environment. (Title). In accordance with the embodiment of independent claim 1, an apparatus for low-damage anisotropic electron dry etching of a substrate includes a plasma reactor for containing a plasma. (Par. 53; Fig. 1). Further, a mechanical support within the plasma reactor is adapted to receive the substrate, the mechanical support being isolated from the creation of the plasma. (Par. 55; FIG. 1). An additional structure is disposed within the plasma reactor proximal to the mechanical support. (Par. 60; FIG. 1). At least a portion of the additional structure extends into the plasma at a time when the plasma reactor contains the plasma. (Par. 60; FIG. 1). A pulse waveform power source is adapted to electrically bias the additional structure to direct the electrons from the plasma towards the substrate, the bias providing sufficient energy for the electrons to etch material from the substrate. (Par. 60 – 63; FIG. 1).

In accordance with the embodiment of claim 16, an apparatus for low-damage anisotropic

low energy electron enhanced etching of a substrate includes a plasma reactor and a plasma creation means at least partially disposed within the plasma reactor for creating a plasma having positively charged ions and electrons. (Par. 53 – 54; FIG. 1). The apparatus further includes a substrate holder disposed within the plasma reactor for receiving a substrate, wherein the substrate holder is isolated from the plasma creation means. (Par. 55; FIG. 1). The apparatus further includes electron etcher means for etching material from the substrate with electrons from the plasma, the electron etching means being in electrical communication with the substrate holder. (Par. 60 – 63; FIG. 1). The apparatus further includes charged particle controller means, disposed proximal to the substrate holder, for controlling the flux of charged particles directed from the plasma onto a substrate disposed on the substrate holder, the flux having sufficient energy for the electrons to etch material from the substrate. (Par. 60 – 63; FIG. 1).

## **VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

The following grounds of rejections are to be reviewed on appeal.

Independent claim 1 and dependent claims 2, 4 – 7, 9 – 11 and 23 – 25 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over *Hayashi* in view of *Lee*.

Independent claim 16 and dependent claims 17 – 18 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over *Hayashi* in view of *Kofuji*.

Dependent claims 19 – 22 and 26 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over *Hayashi* in view of *Kofuji* and further in view of *Lee*.

Claims 1, 2, 4 – 7, 9 – 11 and 23 – 25 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

## VII. ARGUMENT

### A. General Remarks Related to the §103 Rejections

Although Applicants address the §103 rejections of each of claims 1 – 2, 4 – 7, 9 – 11, and 16 – 26 individually below, Applicants believe that a brief summary of the issues to be resolved and the general differences between the proposed combination of *Hayashi* and *Lee*, *Hayashi* and *Kofuji*, and/or *Hayashi*, *Kofuji*, and *Lee*, and claims 1 – 2, 4 – 7, 9 – 11, and 16 – 26 may be helpful.

So far as understood (e.g. from the several Examiner Interviews and prosecution history of this case), an important issue to be resolved on Appeal is whether Applicants' claim language is being given the proper patentable weight as required by the MPEP. As articulated in the Examiner's Interview Summary from August 31, 2006, certain features of Applicants' claims "have been determined to be functional limitations that the prior art structure would be capable of performing." (Examiner's Interview Summary, August 31, 2006, Continuation Sheet). The Interview Summary further states that "no structural difference between the claimed invention and the prior art structure could be determined." (Examiner's Interview Summary, August 31, 2006, Continuation Sheet).

#### ***Applicant's Functional Limitations Must be Evaluated and Considered, Just Like any Other Limitation of the Claim***

Although Applicants do not agree that the structure of the cited references are even "capable of" performing the recited claim features, Applicants submit that the Office Action must evaluate Applicants' functional features just like any other limitation of the claim. See MPEP § 2173.05(g). Specifically, Applicants submit that the Office Action must make a showing that the proposed combination of references disclose, teach or suggest **both** functional and non-functional limitations.

For example, patent claims are allowed every day based solely on functional features performed by well-known structural devices. For example, the Office Action's treatment of Applicants' functional language is tantamount to rejecting a computer implemented invention simply because any general purpose processor *could* be programmed with logic to perform a listing of claimed logical functions.

Accordingly, Applicants submit that the Office Action has used an improper patentability standard for examining Applicants' claims. Or, in the alternative, Applicants submit that the Office uses an arbitrary standard of review, with some examination providing functional features their full patentable weight, while others use a lower standard that requires only that the Office Action show that functional claim elements are met by any reference having a physical structure that is capable of performing such functional features. Applicants submit that the rejection is improper and should be overturned for at least either of these reasons.

#### ***The Office Action Gives Improper Treatment to Applicants' Functional Limitations***

So far as understood, the Office Action apparently agrees that certain functional features are not actually disclosed, taught, or suggested by any of the cited references. Rather, such features of the pending claims have been ostensibly examined in the context of whether the structure of the proposed combination of references are "capable of" performing the recited functions, rather than whether such references actually disclose, teach, or suggest the functional claim elements.

However, even assuming, *arguendo*, that an analysis based on whether the cited art is "capable of" performing the alleged functional language is proper, the analysis used in the Office Action uses an even lower standard, alleging that the structure of the references can be combined *and modified* in order to be capable of meeting the functional limitations of Applicants' claims.

Applicants submit that this low standard is improper and the §103 rejections should be overturned for this reason alone.

As a concrete example, Applicants' claim 1 recites, as one of several elements, "a pulse waveform power source adapted to electrically bias the additional structure to direct the electrons from the plasma towards the substrate, the bias providing sufficient energy for the electrons to etch material from the substrate." The Office Action apparently alleges that the cited art discloses a pulse waveform power source, but does not specifically allege that any of the cited art disclose a pulse waveform power source that is "adapted to electrically bias the additional structure to direct the electrons from the plasma towards the substrate, the bias providing sufficient energy for the electrons to etch material from the substrate." Rather, so far as understood, the Office Action alleges that the pulse wave form power source described in the cited art is *capable of* being modified such that it can "electrically bias the additional structure to direct the electrons from the plasma towards the substrate, the bias providing sufficient energy for the electrons to etch material from the substrate"<sup>1</sup> as claimed.

In *In re Schreiber*, 128 F.3d 1473, 44 USPQ2d 1429 (Fed. Cir. 1997), the Federal Circuit affirmed the BPAI's decision rejecting claims defined in functional language as anticipated by a reference capable of performing the same function. The Office Action rejected claims directed to a funnel top for a popcorn container as anticipated by a funnel top for an oil can, noting that the oil funnel could perform the same function of dispensing popcorn. Schreiber argued that an oil can funnel was not a proper reference for rejecting a popcorn dispensing funnel. The BPAI sustained the rejection, holding the reference was properly applied and met all of the claimed

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<sup>1</sup> See, Office Action, pg. 4, *Emphasis added*, "Since both the positive dc electrical bias power source taught by Hayashi et al and the ac pulse waveform power source taught by Lee are variable power sources, the combination of the two power sources would be structurally *capable of being set at sufficient voltage* so as to provide sufficient energy for the

limitations. On appeal, the court affirmed the BPAL, noting that since the oil can funnel was inherently capable of dispensing popcorn, and all the other limitations were met, the anticipation rejection was proper.

However, among other distinctions, the oil can funnel of the *Schreiber* case would need no modifications at all to perform the function of dispensing popcorn.<sup>2</sup> In stark contrast to the *Schreiber* case, the alleged pulse wave power source alleged to be disclosed in the cited art of the instant case is not capable of performing the same function without a complete reconfiguration to generate the proper waveform. Accordingly, even assuming, *arguendo*, that *Hayashi*, *Kofuji*, and/or *Lee* discloses a pulse waveform power source, Applicants submit that such a pulse waveform power source disclosed in any of these references can not be said to be capable of performing functional limitations found in Applicants' claims.

***The Office Action Does Not Recognize Significant Technical Differences in Ion Etching and Electron Etching***

Although independent claims 1 and 16 are directed to an apparatus for "electron dry etching" and "electron enhanced etching," respectively, each of *Hayashi*, *Kofuji*, and/or *Lee* each relate to ion etching. There are significant technological differences between an apparatus configured for ion etching and an apparatus configured for etching with electrons as claimed. Each use a plasma gas, from which either electrons or ions are accelerated towards a substrate for etching. However, due to the difference in mass between electrons and ions, the mobility of electrons is greater than the mobility of ions. Additionally, electrons and ions appear in different quantities within the plasma and respond differently to the electrical fields they encounter. A

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electrons to etch material from the substrate.")

<sup>2</sup> See, *In re Schreiber* at pg. 1432, "the Board found as a factual matter that the top disclosed in figure 5 of the Harz patent 'is capable of functioning to dispense kernels of popped popcorn in the manner set forth in claim 1.'" )



waveform used to accelerate *ions* for etching does not accelerate *electrons* towards the substrate with sufficient energy to actually etch the substrate.

Accordingly, even assuming, *arguendo*, that the power source alleged to be used for ion etching in *Hayashi*, *Kofuji*, and/or *Lee* is substituted for the claimed “pulse waveform power source,” the waveforms generated by such a power voltage source could not be used to etch material with electrons from the plasma as claimed.

Rather, assuming, *arguendo*, that *Hayashi*, *Kofuji*, and/or *Lee* disclose a power source, significant changes to the configuration of the alleged power source of an ion etching apparatus would be needed to accomplish electron etching. Such significant changes to the waveform are expressly recognized in the Office Action for at least the reason that the Office Action recites that:

(1) the power sources of the alleged prior art must be “*adapted to provide* a desired amount of energy to the electrons in the plasma” (Office Action, pg. 16);

(2) “the combination of the two power sources would be structurally *capable of being set at sufficient voltage* so as to provide sufficient energy for the electrons to etch material from the substrate” (Office Action, pg. 4 - 5); and

(3) “the combination of the two power sources of Hayashi et al. and Kofuji et al. would be structurally *capable of being set at sufficient voltage so as to provide* a desired amount of energy to the electrons in the plasma” (Office Action, pg. 9).

These, and other distinctions are specifically addressed with respect to each of the rejected claims in more detail below.

**B. Claims 1, 2, 4 – 7, 9 – 11 and 23 – 25 are Patentable Over *Hayashi* in View of *Lee***

The Office Action indicates that claims 1, 2, 4 – 7, 9 – 11 and 23 – 25 are rejected under 35 U.S. C. §103(a) as being allegedly unpatentable over U.S. Patent No. 4,950,376 to Hayashi ("*Hayashi*") in view of U.S. Patent No. 5,279,669 to Lee ("*Lee*"). For at least the reasons set forth below, the rejection should be overturned and the claims allowed.

***Independent Claim 1***

Applicants submit that independent claim 1, as amended, is allowable over the proposed combination of *Hayashi* and *Lee* for at least the reason that the proposed combination of *Hayashi* and *Lee* does not disclose, teach, or suggest each and every element of claim 1.

For example, Applicants submit that the proposed combination of *Hayashi* and *Lee* does not disclose, teach, or suggest at least the feature of "*a pulse waveform power source adapted to electrically bias the additional structure to direct the electrons from the plasma towards the substrate, the bias providing sufficient energy for the electrons to etch material from the substrate.*"

Specifically, the Office Action alleges that the functional limitations of the claims "have been fully considered, and determined to not result in a structural difference between the claimed invention and the cited prior art." (Office Action, pg. 16). "As a specific example, the positive dc electrical bias power sources taught by Hayashi et al. and the fact that these power sources are of variable voltage, and thus capable of being adapted to provide a desired amount of energy to the electrons in the plasma, that makes the apparatus taught by the combination of Hayashi et al. with Lee and/or Kofuji et al. structurally capable of biasing the substrate holder and the additional structure so as to direct electrons to the substrate with sufficient energy to etch material from the

substrate.” (Office Action, pg. 16).

*Hayashi* does not disclose a pulse waveform power source at all, and thus cannot meet the claimed element of “a pulse waveform power source adapted to electrically bias the additional structure to direct the electrons from the plasma towards the substrate, the bias providing sufficient energy for the electrons to etch material from the substrate” recited in claim 1.

Even assuming, *arguendo*, that *Lee* discloses a pulse waveform power source as alleged, *Lee* uses electron cyclotron resonance (ECR) “thereby keeping electrons confined within plasma 16.” (col. 9, line 16). Accordingly, looking to col. 6, line 50 – col. 7, line 25, as cited in the Office Action, the biased voltage on extraction grid 60 does not provide “sufficient energy for electrons to etch material from the substrate” as claimed. In fact, there is no mention at all of directing electrons toward the substrate. Rather, the electrons are “confined within plasma 16” (col. 9, line 16) because of the ECR.

Thus, contrary to the allegation in the Office Action, the biased voltage of *Lee* is not capable of biasing “the additional structure to direct the electrons from the plasma towards the substrate, the bias providing sufficient energy for the electrons to etch material from the substrate” as recited in claim 1. Rather, *Lee* expressly states that the electrons are confined within the plasma 16.

Thus, it is not insignificant that neither *Hayashi* nor *Lee* disclose an apparatus for electron etching. Significant changes are required to convert an ion etching apparatus to an electron etching apparatus as claimed. Such significant changes appear to be recognized in the Office Action in that the Office Action even recites that the power sources of the alleged prior art must be “*adapted to provide* a desired amount of energy to the electrons in the plasma” (Office Action, pg. 16) and that “the combination of the two power sources would be structurally *capable of being set*

*at sufficient voltage* so as to provide sufficient energy for the electrons to etch material from the substrate” (Office Action, pg. 4 - 5).

Accordingly, Applicants submit that the alleged pulse waveform power source of *Lee* is not capable of, or configured to “bias the additional structure to direct the electrons from the plasma towards the substrate, the bias providing sufficient energy for the electrons to etch material from the substrate” as recited in claim 1. Thus, independent claim 1 should be allowed for this reason alone.

Accordingly, Applicants respectfully submit that independent claim 1 is allowable over the proposed combination of *Hayashi* and *Lee* for at least these reasons. Furthermore, dependent claims 1 - 2, 4 - 7, 9 - 11, and 23 - 25 are allowable for at least the reason that they depend from allowable independent claim 1.

***Dependent Claims 2, 4 - 7, 9 - 11 and 23 - 25***

Applicants submit that dependent claims 2, 4 - 7, 9 - 11 and 23 - 25 are allowable as a matter of law for at least the reason that claims 2, 4 - 7, 9 - 11 and 23 - 25 contain all the features and elements of independent claim 1, which Applicants believe to be allowable. For at least this reason, Applicants request that the rejection of claims 2, 4 - 7, 9 - 11 and 23 - 25 be overturned.

**C. Claims 16 - 18 are Patentable Over *Hayashi* in View of *Kofuji***

The Office Action indicates that claims 16 - 18 are rejected under 35 U.S. C. 103(a) as being allegedly unpatentable over *Hayashi* in view of U.S. Patent No. 6,231,777 of *Kofuji* (“*Kofuji*”). For at least the reasons set forth below, the rejection should be overturned and the claims allowed.

### ***Independent Claim 16***

Applicants submit that independent claim 16 is patentable over the proposed combination of *Hayashi* and *Kofuji* for at least the reason that neither *Hayashi* nor *Kofuji*, separately or in combination discloses “charged particle controller means, disposed proximal to the substrate holder, for controlling the flux of charged particles directed from the plasma onto a substrate disposed on the substrate holder, ***the flux having sufficient energy for the electrons to etch material from the substrate***” as recited in claim 16.

As an initial matter, *Hayashi* does not disclose an apparatus for electron etching at all, and thus cannot meet the claimed element of “charged particle controller means, disposed proximal to the substrate holder, for controlling the flux of charged particles directed from the plasma onto a substrate disposed on the substrate holder, the flux having sufficient energy for the electrons to etch material from the substrate” recited in claim 16.

Further, even assuming, *arguendo*, that *Kofuji* discloses that “electrons are drawn to the substrate during the positive swing of the pulsed electrical bias” *Kofuji* does not disclose “controlling the flux of charged particles directed from the plasma onto a substrate disposed on the substrate holder, the flux having sufficient energy for the electrons to etch material from the substrate” recited in claim 16. Rather, the electrons are used to neutralize the charge on the substrate and do not receive enough bias to actually “etch material from the substrate” as claimed.

Thus, it is not insignificant that neither *Hayashi* nor *Kofuji* disclose an apparatus for electron etching. Significant changes are required to convert an ion etching apparatus to an electron etching apparatus as claimed. Such significant changes appear to be recognized in the Office Action in that the Office Action even recites that the power sources of the alleged prior art must be “***adapted to provide*** a desired amount of energy to the electrons in the plasma” (Office

Action, pg. 16) and that "the combination of the two power sources of Hayashi et al. and Kofuji et al. would be structurally *capable of being set at sufficient voltage so as to provide* a desired amount of energy to the electrons in the plasma" (Office Action, pg. 9).

Thus, neither *Hayashi* nor *Kofuji*, separately or in combination discloses "charged particle controller means, disposed proximal to the substrate holder" that is capable of, or configured for, "controlling the flux of charged particles directed from the plasma onto a substrate disposed on the substrate holder, the flux having sufficient energy for the electrons to etch material from the substrate" as recited in claim 16.

Accordingly, Applicants respectfully submit that independent claim 16 is allowable over the proposed combination of *Hayashi* and *Kofuji* for at least these reasons. Furthermore, dependent claims 17 – 22 are allowable for at least the reason that they depend from allowable independent claim 16.

***Dependent Claims 17 - 18***

Applicants submit that dependent claims 17 – 18 are allowable as a matter of law for at least the reason that claims 17 – 18 contain all the features and elements of independent claim 16, which Applicants believe to be allowable. For at least this reason, Applicants request that the rejection of claims 17 – 18 be overturned.

**D. Claims 19 – 22 and 26 are Patentable Over *Hayashi* in View of *Kofuji* in View of *Lee***

The Office Action indicates that claims 19 – 22 and 26 are rejected under 35 U.S. C. 103(a) as being allegedly unpatentable over *Hayashi* in view of *Kofuji*" as applied to claim 16 and further in view of *Lee*. Applicants submit that dependent claims 19 – 22 and 26 are allowable as a matter of law for at least the reason that claims 19 – 22 and 26 contain all the

features and elements of independent claim 16, which Applicants believe to be allowable. For at least this reason, Applicants request that the rejection of claims 19 – 22 and 26 be overturned.

**E. Claims 1, 2, 4 – 7, 9 – 11, and 23 – 25 Comply with 35 U.S.C. §112**

The Office Action rejects claims 1, 2, 4 – 7, 9 – 11, and 23 – 25 under 35 U.S.C. §112, second paragraph, as being allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as the invention. Applicant respectfully submits that each of claims 1, 2, 4 – 7, 9 – 11, and 23 – 25 are not indefinite and fully comply with 35 U.S.C. §112 for at least the reasons set forth below. For at least the reasons set forth below, the rejection should be overturned and the claims allowed.

The Office Action alleges that the phrase “the creation of the plasma” in line 5 of claim 1 lacks antecedent basis “since the claim does not recite any sort of plasma creation means” and that “claims 2, 4 – 7, 9 – 11, and 23 – 25 are rejected due to their dependence on claim 1.

Applicants submit that “a plasma” is defined in line 2 of claim 1 and thus has antecedent basis. Accordingly, so far as understood, the rejection alleges that the phrase “the creation” lacks antecedent basis.

Inherent components of elements recited have antecedent basis in the recitation of the components themselves. MPEP 2173.05(e). Although “a creation” is not previously defined, Applicants submit that the claim is clear to one skilled in the art in that the plasma must have been created somehow and thus is an inherent component.

Accordingly, Applicant maintains that each of claims 1, 2, 4 – 7, 9 – 11, and 23 – 25 are clear as currently presented, and do not lack antecedent basis as alleged. However, should the

rejection under §112 not be overturned, and all other issues resolved, Applicant is open to proposing an amendment that does not alter the scope of the pending claims.



### CONCLUSION

Based upon the foregoing discussion, Applicant respectfully requests that the Examiner's rejection of claims 1 - 2, 4 - 7, 9 - 11, and 16 - 26 be overruled by the Board, and that the application be allowed to issue as a patent with all pending claims. No additional fees are believed to be due in connection with this Appeal Brief. If, however, any additional fees are deemed to be payable, you are hereby authorized to charge any such fees to deposit account No. 20-0778.

Respectfully submitted,



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## **APPENDIX A - CLAIMS**

1. An apparatus for low-damage anisotropic electron dry etching of a substrate, comprising:  
a plasma reactor for containing a plasma; and  
a mechanical support within said plasma reactor adapted to receive said substrate, said mechanical support isolated from the creation of the plasma;  
an additional structure disposed within the plasma reactor proximal to the mechanical support, at least a portion of the additional structure extending into the plasma at a time when the plasma reactor contains the plasma; and  
a pulse waveform power source adapted to electrically bias the additional structure to direct the electrons from the plasma towards the substrate, the bias providing sufficient energy for the electrons to etch material from the substrate.
2. The apparatus of claim 1, wherein said additional structure is dc electrically biased.
4. The apparatus of claim 1, wherein said additional structure is both ac and dc electrically biased.
5. The apparatus of claim 1, wherein said mechanical support is electrically isolated from the plasma creator.

6. The apparatus of claim 5, wherein said additional structure is electrically isolated from both the mechanical support and from the plasma creator.

7. The apparatus of claim 6, wherein said additional structure is dc electrically biased

9. The apparatus of claim 6, wherein said additional structure is both ac and dc electrically biased.

10. The apparatus of claim 1, further including:

an electrically insulating member disposed on the mechanical support, the electrically insulating member circumscribing a portion of the mechanical support.

11. The apparatus of claim 10, wherein the electrically insulating member is in communication with the additional structure.

16. An apparatus for low-damage anisotropic low energy electron enhanced etching of a substrate, comprising:

a plasma reactor;

plasma creation means at least partially disposed within the plasma reactor for creating a plasma having positively charged ions and electrons;

a substrate holder disposed within the plasma reactor for receiving a substrate, wherein the substrate holder is isolated from the plasma creation means;

electron etcher means for etching material from the substrate with electrons from the plasma, wherein the electron etching means is in electrical communication with the substrate holder; and

charged particle controller means, disposed proximal to the substrate holder, for controlling the flux of charged particles directed from the plasma onto a substrate disposed on the substrate holder, the flux having sufficient energy for the electrons to etch material from the substrate.

17. The apparatus of claim 16, wherein the charged particle controller means is adapted to control the energy of charged particles being impacted onto the substrate.

18. The apparatus of claim 16, further including:

a charged particle blocking means for preventing charged particles in the plasma from reaching the substrate unless the charged particles pass through the charged particle controller means.

19. The apparatus of claim 16, further comprising:

a pulse waveform power source adapted to electrically bias the charged particle controller means to direct the electrons from the plasma towards the substrate.

20. The apparatus of claim 19, wherein said pulse waveform power source is further adapted to periodically bias the charged particle controller means to direct ions from the plasma towards the substrate to electrically neutralize the substrate.

21. The apparatus of claim 19, wherein said pulse waveform power source is adapted to cycle between a positive electrical potential and a negative electrical potential, and wherein the positive potential is such that electrons having kinetic energy less than 100 electron-volts are attracted to the substrate and etch material therefrom.

22. The apparatus of claim 21, wherein a waveform of a pulse wave supplied by the pulse waveform power source is defined by a period having a first predetermined interval at the positive electrical potential and a second predetermined interval at the negative electrical potential, wherein during the first interval electrons are directed to the substrate, and wherein the second interval is of duration such that a sufficient number of ions are directed to the substrate to substantially neutralize the accumulated electrons on the substrate.

23. The apparatus of claim 1, wherein said pulse waveform power source is further adapted to periodically bias the additional structure to direct ions from the plasma towards the substrate to electrically neutralize the substrate.

24. The apparatus of claim 1, wherein said pulse waveform power source is adapted to bias the additional structure such that ions of the plasma are directed to the substrate and electrically neutralize the substrate without damaging the substrate.

25. The apparatus of claim 1, wherein said pulse waveform power source is adapted to cycle between a positive electrical potential and a negative electrical potential, and wherein the positive potential is such that electrons having kinetic energy less than 100 electron-volts are attracted to the substrate and etch material therefrom.

26. The apparatus of claim 21, wherein a waveform of a pulse wave supplied by the pulse waveform power source is defined by a period having a first predetermined interval at the positive electrical potential and a second predetermined interval at the negative electrical potential, wherein during the first interval electrons are directed to the substrate to etch the material from the substrate, and wherein the second interval is of duration such that a sufficient number of ions are directed to the substrate to substantially neutralize the accumulated electrons on the substrate.

## **APPENDIX B – EVIDENCE**

There are no related proceedings to be considered in this Appeal. Therefore, no such proceedings are identified in this Appendix.

### **APPENDIX C – RELATED PROCEEDINGS**

There are no related proceedings to be considered in this Appeal. Therefore, no such proceedings are identified in this Appendix.